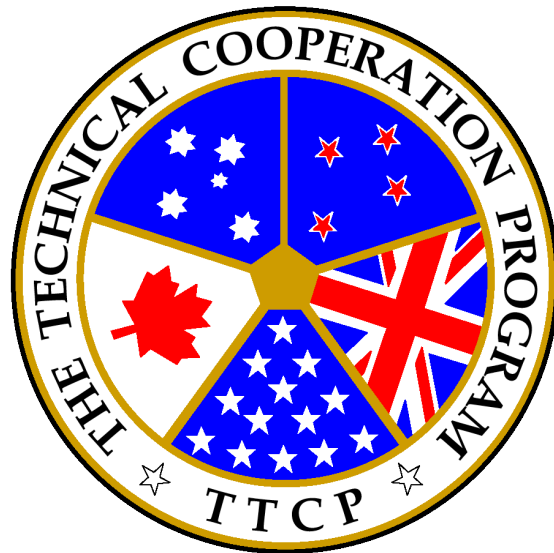


TTCP

Uninhabited Air Vehicle Systems



Presentation to NDIA
Paul Pace
Chair AER TP-6



Thank You for Inviting Me to Palm Springs





History of TTCP UAV Activity

Pan-TTCP “UAVs in the Battlefield” Workshop

UAV Concept of Use Workshops

UAV Technology Assessment Work

Global Hawk Studies

**AER AG-1
UAV Systems &
Technologies**

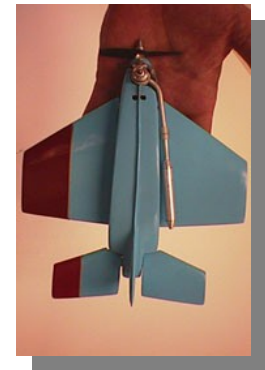
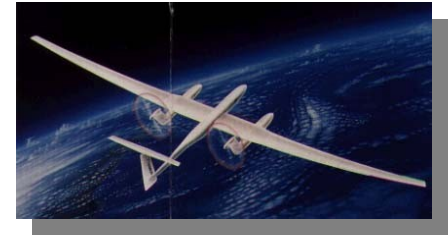
**JSA AG-8 UAV
Concepts**

**AER TP-6 Uninhabited
Air Systems**

1998 1999 2000 2001 2002



AG-8 Workshop



Early



Tactical



Strategic

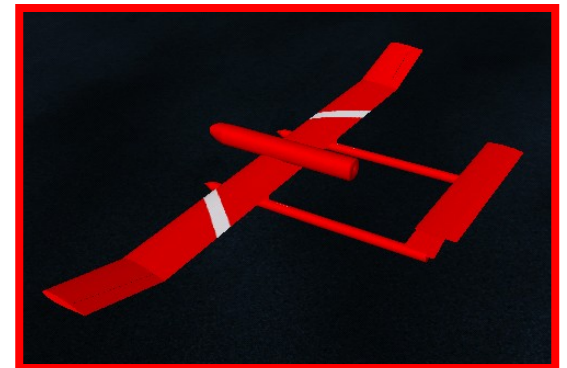
Future
CONOPS?

time →



Issues Arising from Pan TTCP UAV Conference

- What are the most promising & likely future military applications of UAV technology? (Future CONOPS)
- What are the technical issues associated with future coalition operation of UAV's?
- Into what UAV-related technology areas should the TTCP R&D investment be directed?





AG-8 Approach

- How do we identify UAV Critical Capability Needs and the Critical Technologies likely to solve



Two ways:

- (1) Experimental Approach
- (2) Operational Analysis Approach



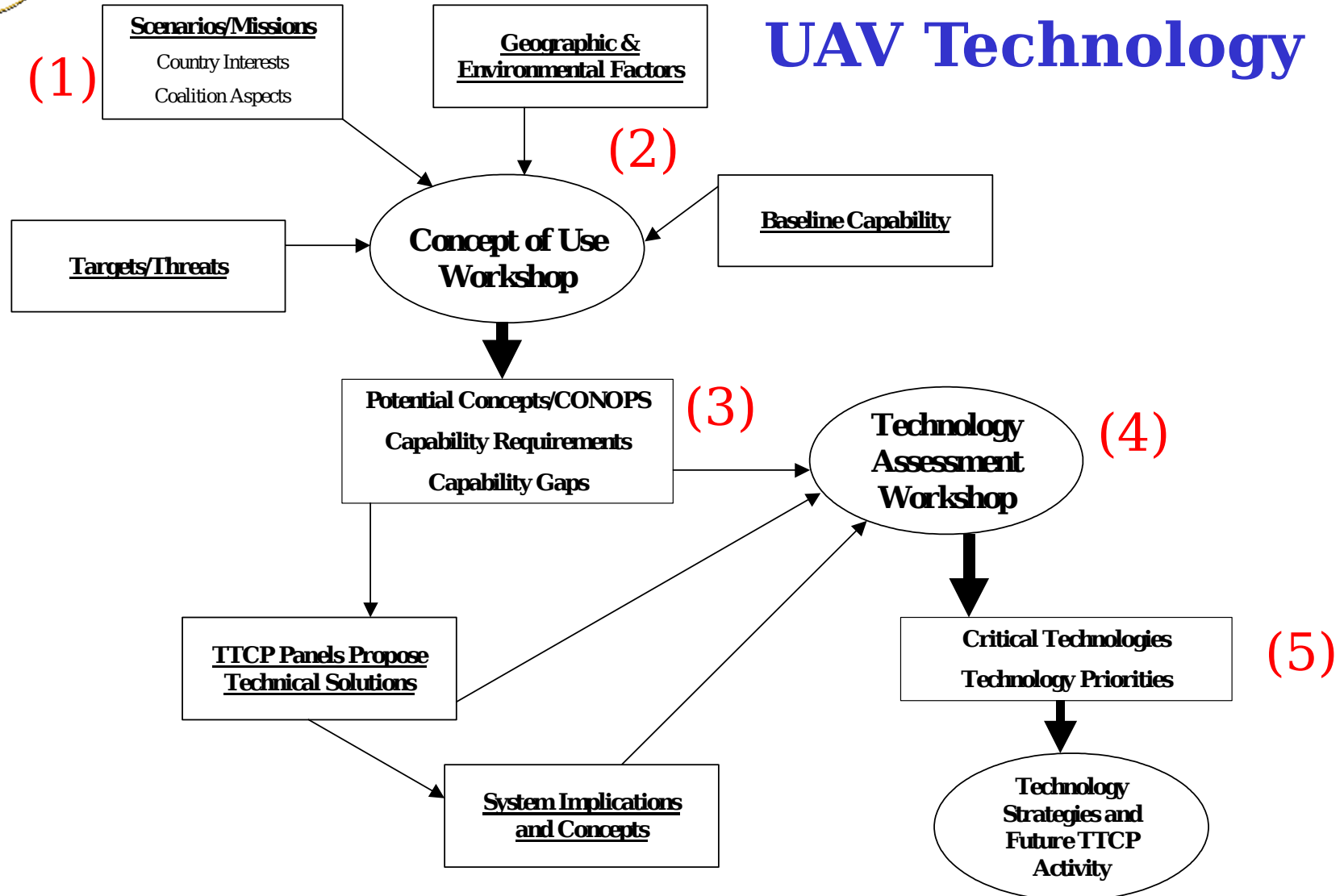


AG-8 Activity

- April, June, Nov 1999 Development of critical technology assessment methodology
- 2000 Global Hawk overflight of Canada (date TBD)
- May 2000 - Washington DC Pan-TTCP UAV Technology Assessment Workshop.
- May 2001 - Wrap-up, Adelaide (Observers to Global Hawk overflights of Australia)



AG-8 Methodology to Determine Critical UAV Technology





Concepts of Use Workshop

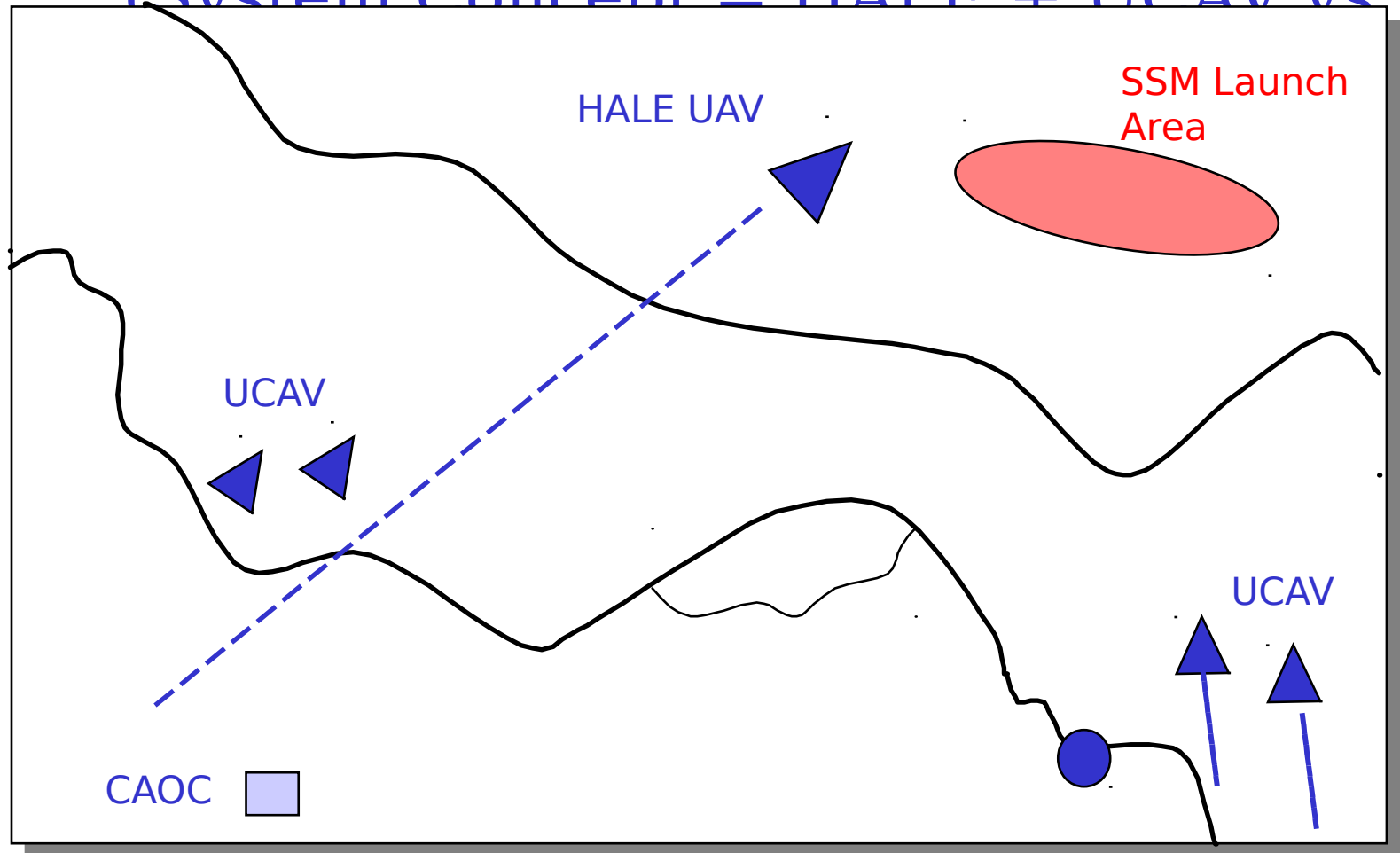
- **High Intensity Conflict Scenario**
 - *Hunting and killing Surface-to-surface Missile (SSM) systems*
 - High Altitude Long Endurance (HALE) UAV
 - Unmanned Combat Air Vehicle (UCAV)
- **Operation Other Than War (OOTW) Scenario**
 - *Attacking time critical target*
 - Air Launched UAV (ALUAV) with manned aircraft
 - Tactical UAV





Scenario 1 - High Intensity Conflict

(System Concept = HALE + UCAV vs





Technology Assessment Workshop

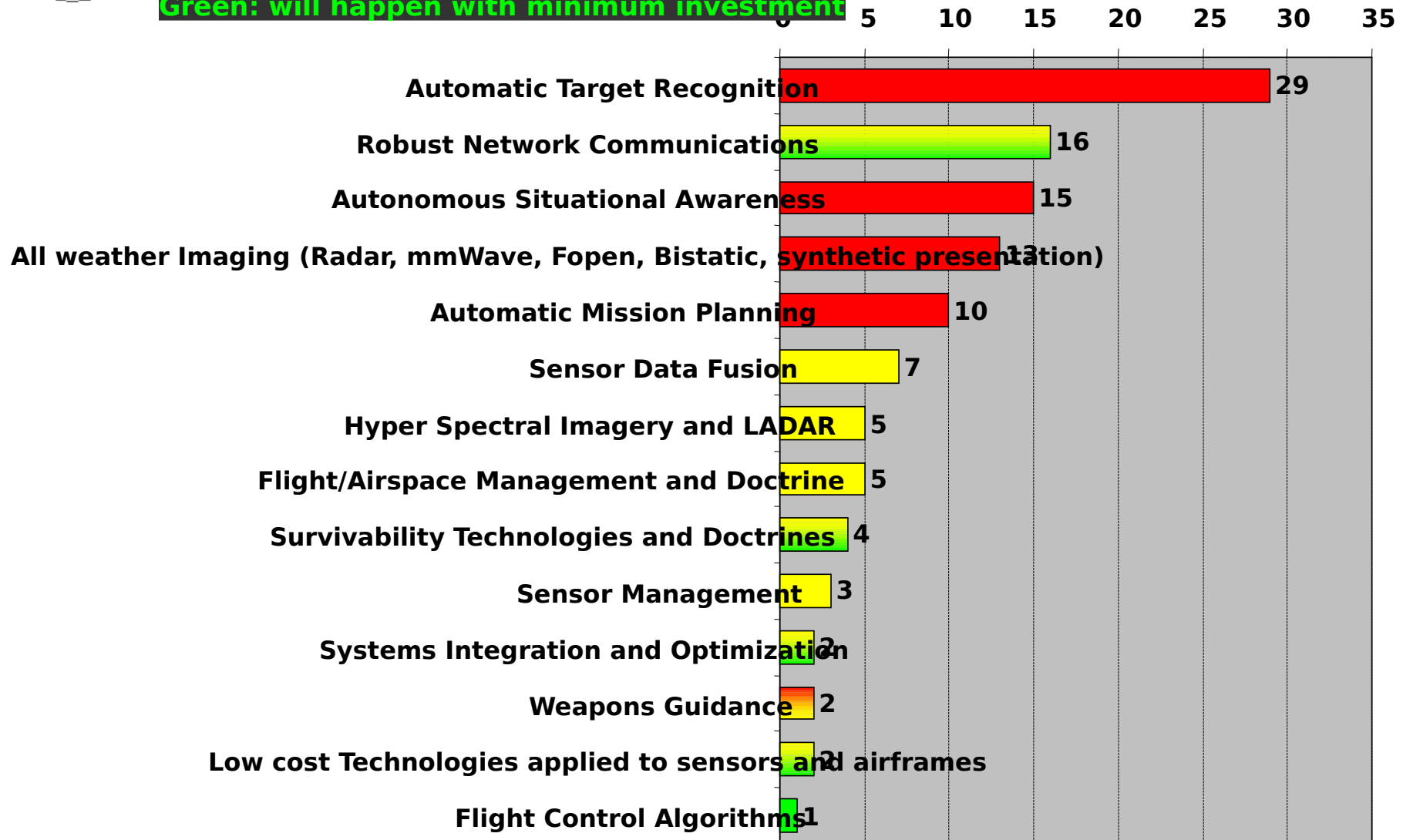
- Held May 16-18, 2000 in Washington DC.
- 46 Military and civilian technical experts from 4 nations.
- Representation from DRE's, Air SP, D Mar Strat, Army Doctrine, NRC.
- 3 syndicates discussing all 4 scenarios.
- Common themes emerged and clear vision of technology challenges and priorities for R&D.
- All UAV concepts determined to be of high military value, but cost and risk are high.



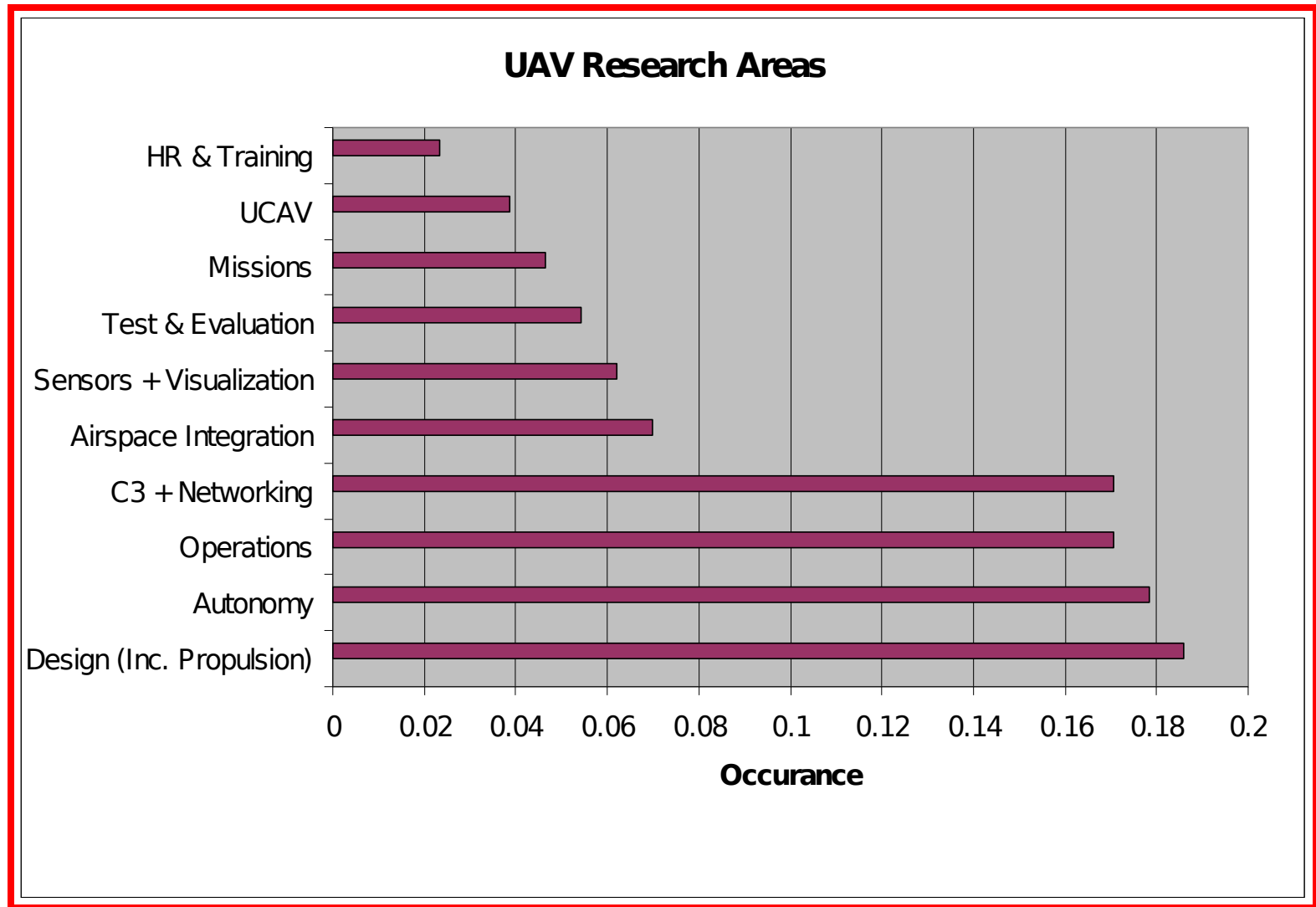
Technology Ratings

Red: Significant R&D required **Yellow: Continued R&D will probably get us there**

Green: will happen with minimum investment



SURVEY BASED ON AUVSI DATA Spring 2003



JSA AG-8

Recommendations

- Automated Target Detection/Recognition
- Automated Mission Planning
- Automated Dynamic Mission and Flight Management
- All Weather Imaging
- Battlespace Connectivity
- UAVs in Urban Operations



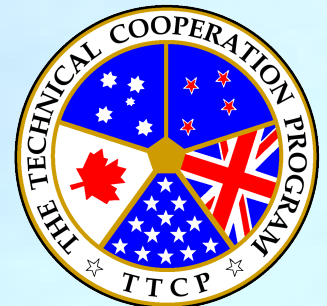
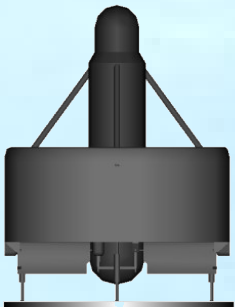
TTCP AER TP-6 Summary

AER TP-6 Panel
Uninhabited Aerial Vehicle
Systems
Chair, Leaders of KTAs, NL

KTA 6A
Integrated Airspace
Operations
Leader: Matthew South, USN

KTA 6B
Autonomous Operation
Leader: Bob Frampton, UK

KTA 6C
Targets
Leader: Jim Stewart, Aus





The Strategic Technology Drivers for Uninhabited Aerial Vehicle (UAV) Systems Include

- Autonomy
- Communication Bandwidth
- Data and Information Fusion

Secondary Strategic Technologies Include

- Performance (Payload, Range, Maneuverability, Agility)
- Survivability
- Affordability
- Safety
- Mission Effectiveness
- Sustainability



Research Strategic Direction



-
- Autonomy
-
- Bandwidth
- Fusion



PAN AER UAV Guidance Requests

- Mission requirements drive vehicle design. Provide warfighter requirements
 - ∇• for small to micro UAVs
 - Operational usage topics including roles, aircraft usage and life expectations, operational environments including threats, worldwide conditions, maintenance or other logistic support constraints, etc.
 - ∇• Airspace integration issues
 - ∇• In-service feedback on design, operation and ownership i.e. capability limitations, cost / manpower drivers, in-field repair needs, reliability / maintainability, ops requirements, etc.
 - ∇• Roles envisaged for r/w UAVs and hence design drivers.
-

Way Ahead

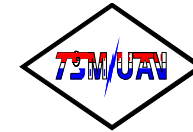
Pan TTCP UAV
Requirements Workshop



Small/Micro UAVs and Urban Operations



Allied Participation



• DRDC, CFEC, CIC

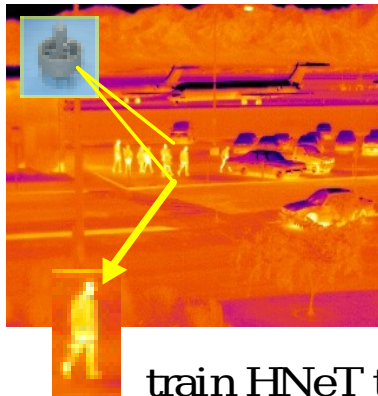


• DERA

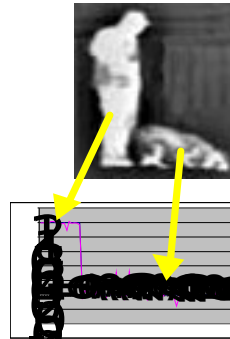


→ Small Observer Program

→ HNeT neural processing algorithms

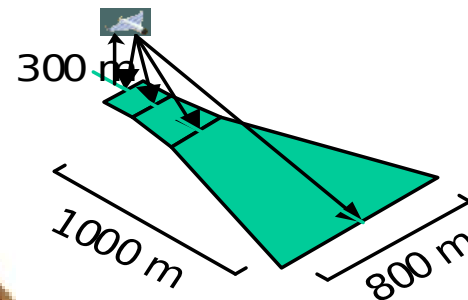


train HNeT to recognize humans



response recall

→ Experimentation Support & Cold Weather Field Testing

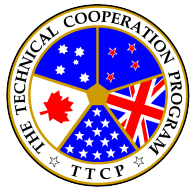


Enhanced Surveillance System

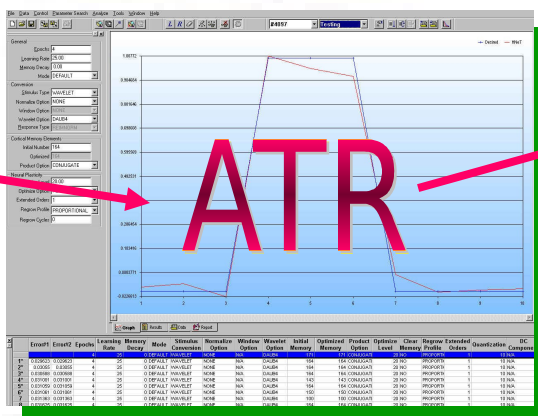
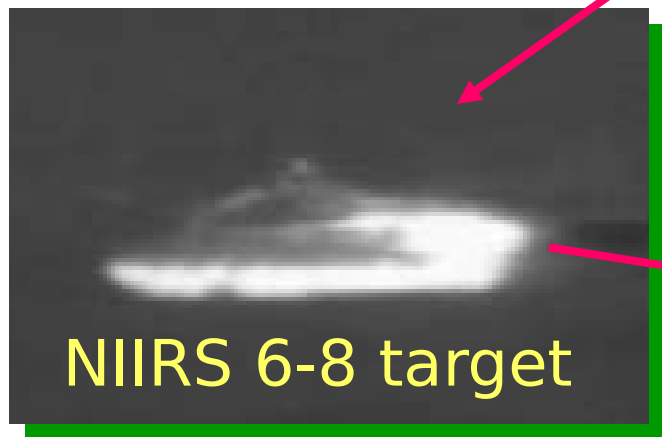
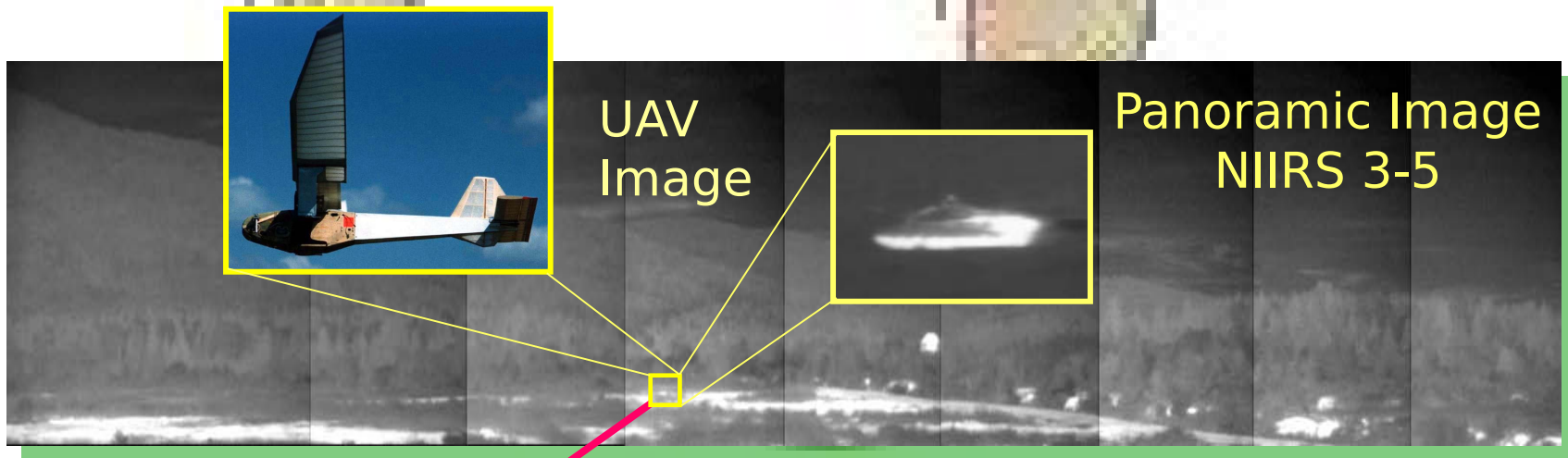


- Turret “see-through” panoramic vision
- Combination of EO/IR and HRR radar, UAV integration
- Automat detection recognition and



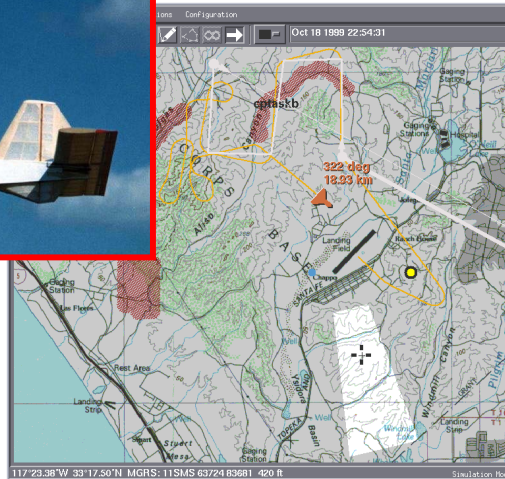


Concept of Operation



Target
marked
tracked

Small UAV LAV Integration

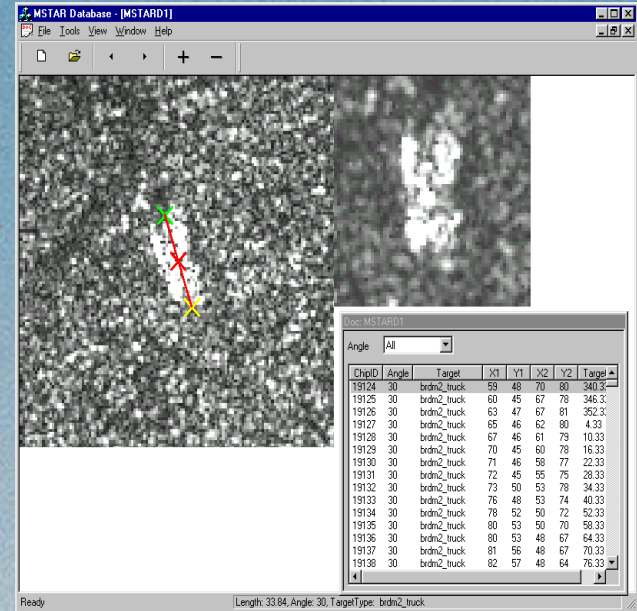
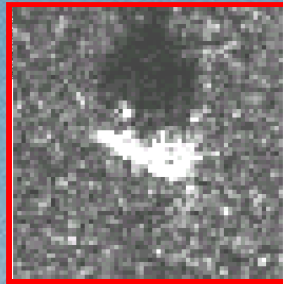


AUTO 16:42:39 04-18-2002
12UWA09028851 49 m
25U 0.4 km
232 deg

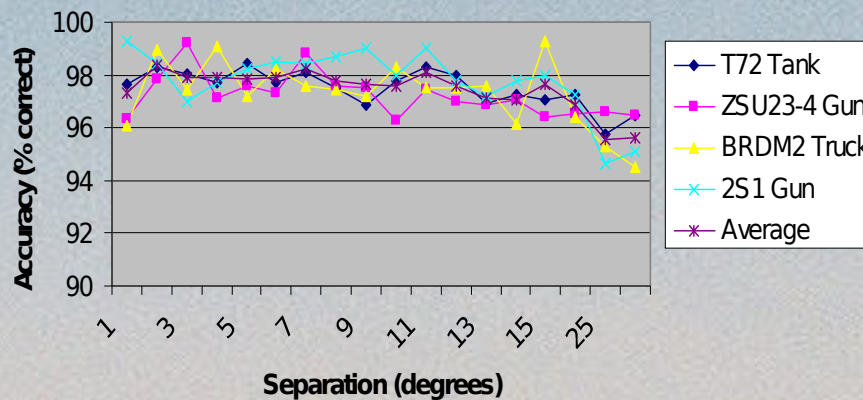
Automated Target Detection Tracking Recognition

Leopard Tank Coef: 0.164747	Unknown	Leopard Tank Coef: 0.556450	Unknown
Unknown	Unknown		

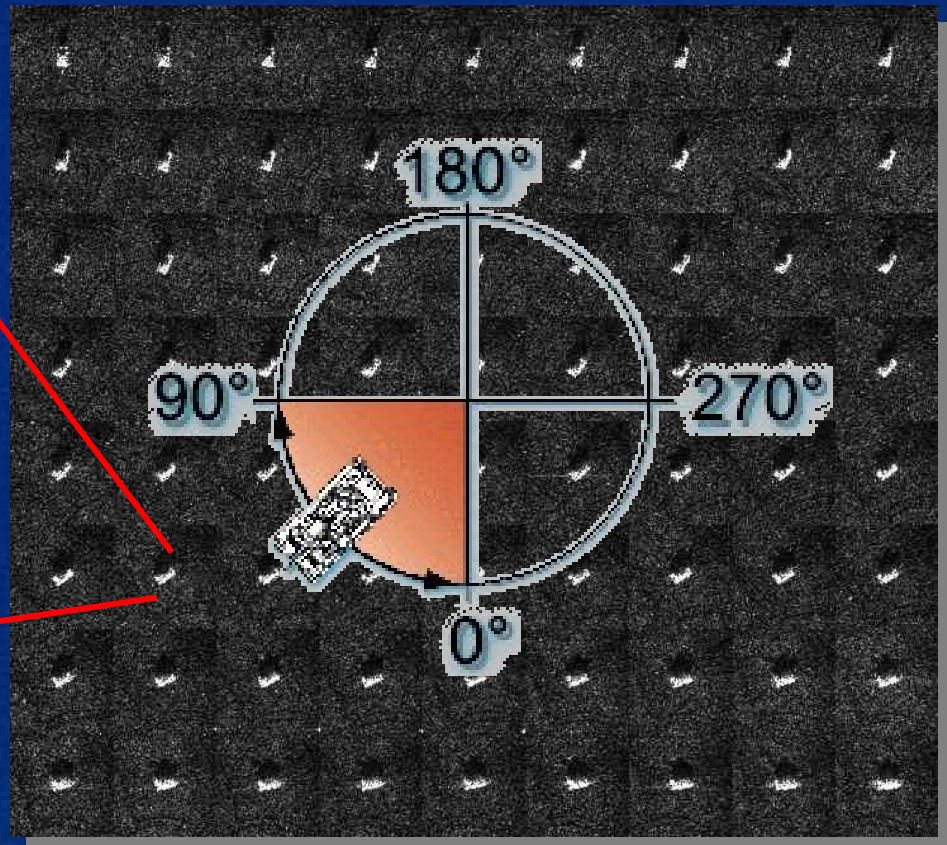
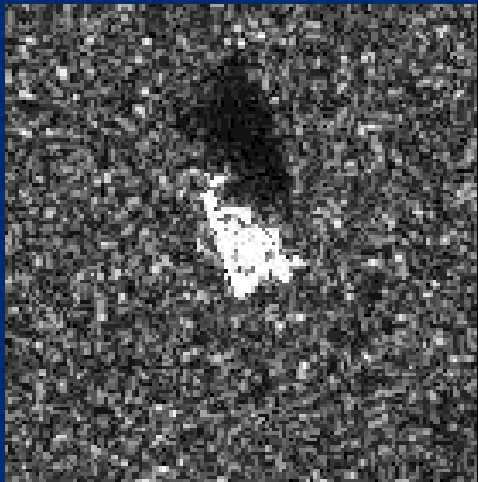




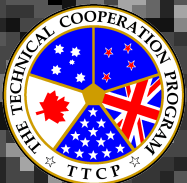
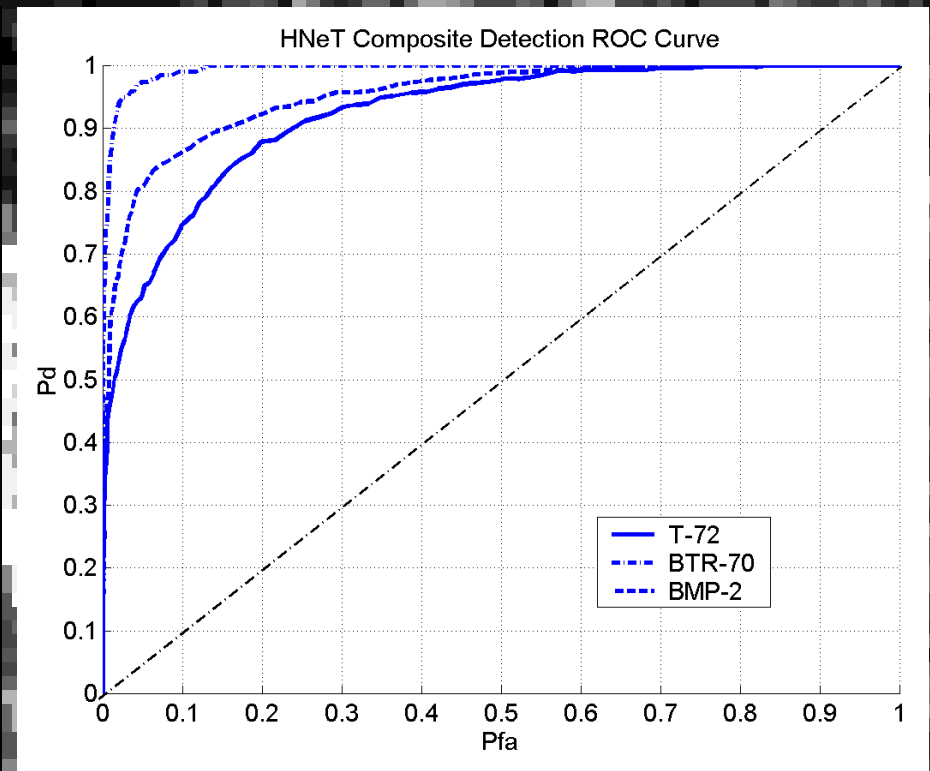
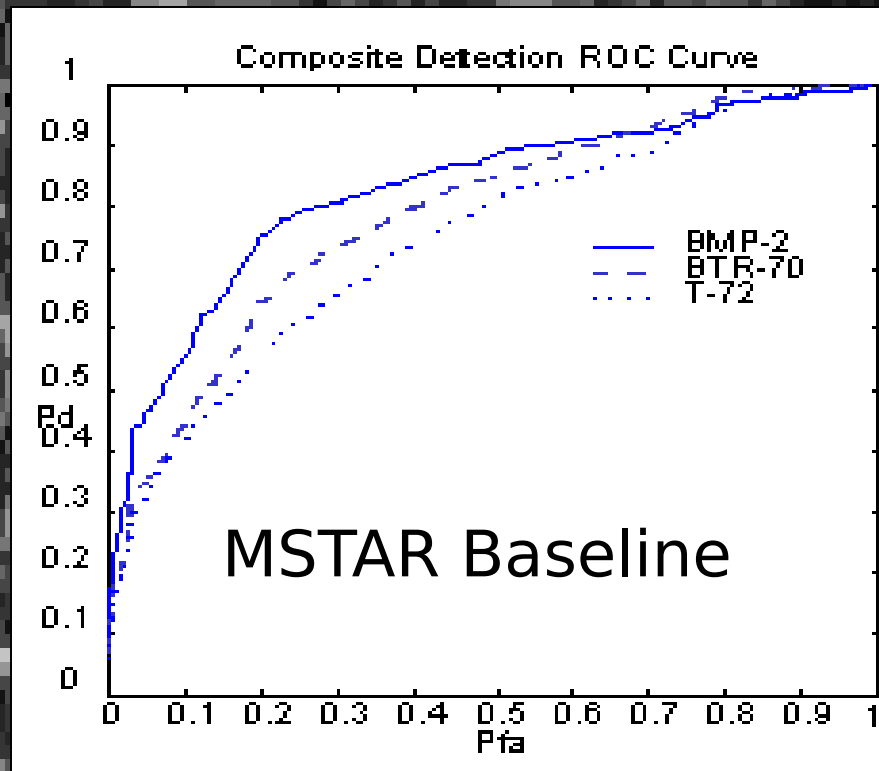
A diagram of a cone with a small object (a toy car) at the base. The cone is formed by a vertical line and a diagonal line meeting at a point at the top. The base is a small circle. The object is a small toy car with a red body and black wheels, positioned on the base of the cone.



MSTAR SAR Imagery

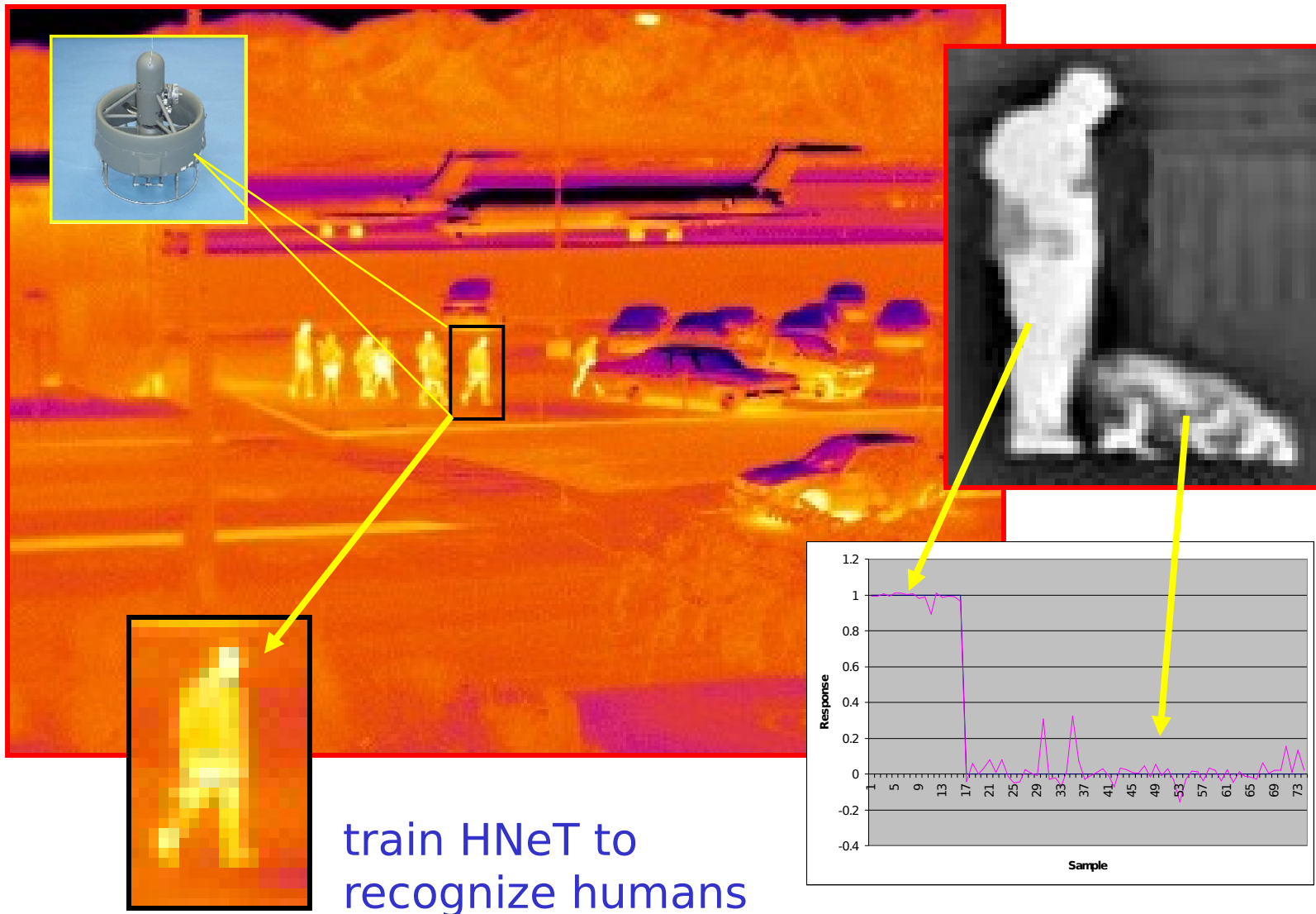


Receiver Operating Conditions (R



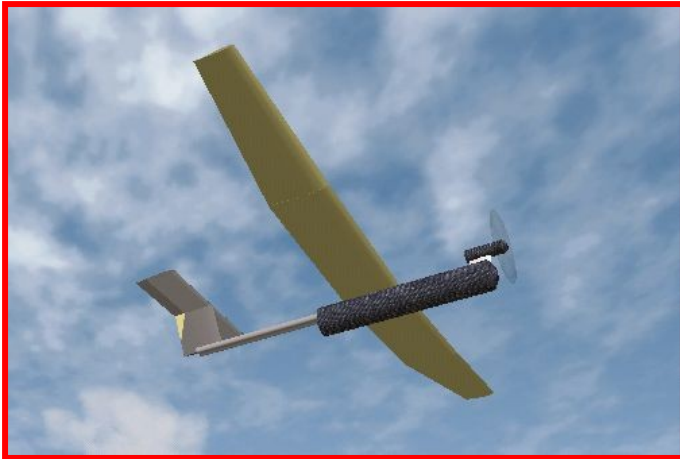
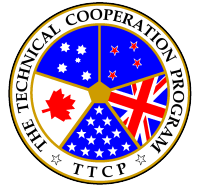
Fraction of target images declared targets
Fraction of confuser images declared targets

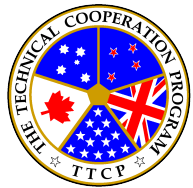
Detection of Humans in IR Imagery



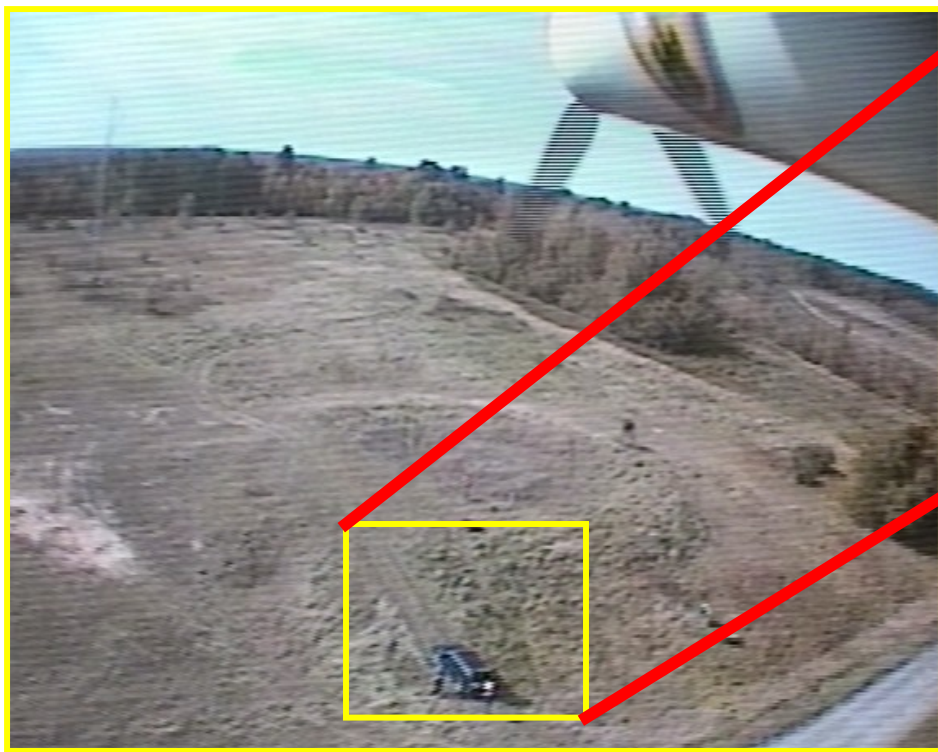
response recall

Small UAV Multiple FOV Imaging

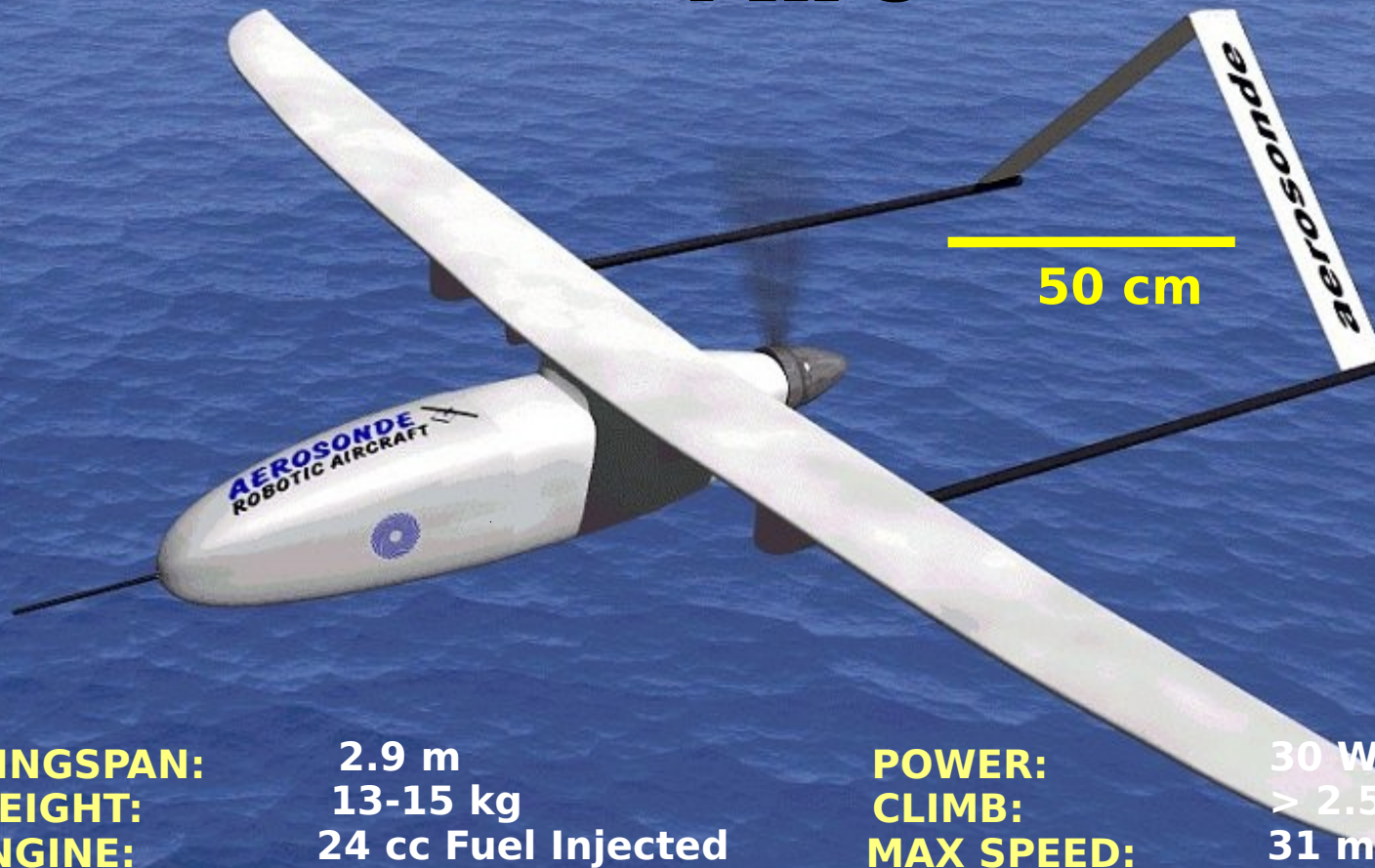




Detection and Identification of Small Targets



AEROSONDE - Robotic Aircraft Mk 3



WINGSPAN:	2.9 m	POWER:	30 W (50 W Peak)
WEIGHT:	13-15 kg	CLIMB:	> 2.5 m/s (9 km/hr)
ENGINE:	24 cc Fuel Injected	MAX SPEED:	31 m/s (110 km/hr)
PERFORMANCE:	Cruise 80-150 kph	PAYLOAD AREA:	100 x 120 x 180 mm
	Range >3,000 km, >30 h	LAUNCH:	Car Roof @ 80 km/hr
	Surface to 6 km	RECOVERY:	Skid Landing < 300 m
PAYLOAD:	Up to 5 kg (12 hrs flight)	FLIGHT STAFF:	Controller, Engineer, & Pilot/Maintenance
NAVIGATION:	GPS/DGPS	FLIGHT COMMAND:	1 Person ~ Several A
COMMUNICATION:	UHF Radio, LEO Satellite		



EO PAYLOADS

- **Video Imagery to Ground Control Station**
- **HiRes Still Images Stored On Board UAV**
- **LoRes Thumbnails (Still Images) to GCS**
- **HiRes Image to GCS (~ 5 minutes delay)**
- **WWW Dissemination of Images in NRT**
- **Fixed Orientation Cameras (with Zoom)**
- **LOS: Range & Control Link ~ 60km**

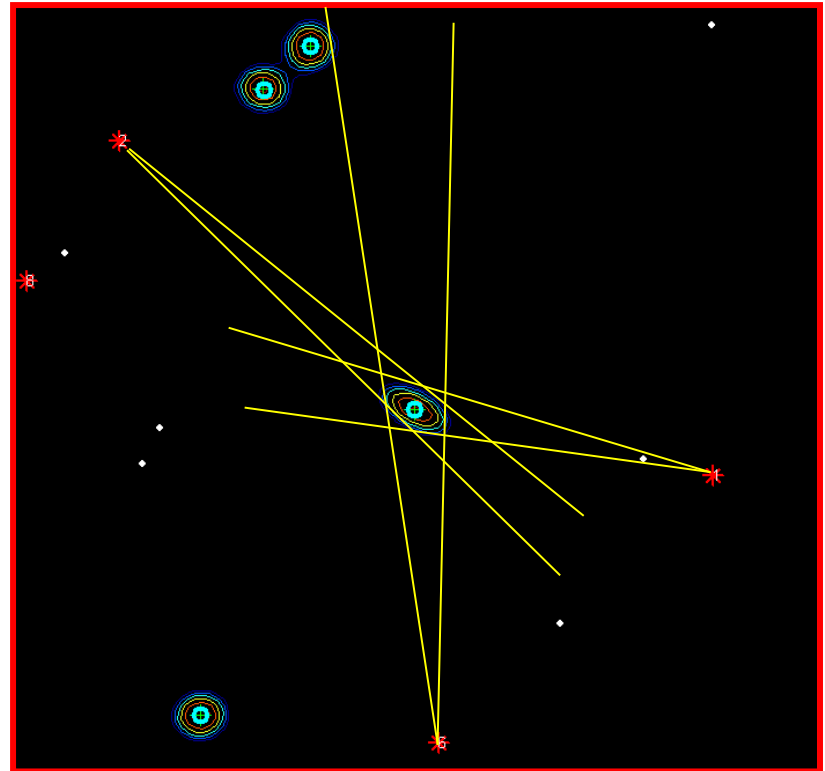




Basic Approach



- Geolocate Emitters using multiple UAVs (This may require multiple types of payloads in a sequenced/scheduled manner)
- Cue UAV platform fitted with other (EO) sensors to identify.





TTCP Advanced Sensor Package

- real-time processing
- advanced ATR
- advanced EO sensor
- 220 LB payload
- auto target detection
- auto target tracking
- stealth
- Chem/bio detection
- acoustic sensor
- weapons compatible
- ACN

